Consultants in Acoustics, Vibration & Structural Dynamics
email: sydney@renzotonin.com.au
website: www.renzotonin.com.au

CITY ONE, WYNYARD

NOISE AND VIBRATION IMPACT ASSESSMENT FOR

CONCEPT APPLICATION PHASE

TE410-01F02 (REV 1) NOISE ASSESSEMENT REPORT.DOC

24 APRIL 2009

Prepared for:

Thakral Holdings Limited

Level 12, 301 George Street

Sydney NSW 2000

Attention:

Member of the Association of Australian Acoustical Consultants

Sydney (Head Office)
Renzo Tonin & Associates (NSW) Pty Ltd
ABN 29 117 462 861
1/418A Elizabeth St., SURRY HILLS, NSW 2010
PO Box 877 STRAWBERRY HILLS, NSW 2012
Ph (02) 8218 0500 Fax (02) 8218 0501

Melbourne
Brisbane
Gold Coast
Kuwait

DOCUMENT CONTROL

Date	Revision History	Non-Issued Revision	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
22.04.2009	Prepare draft report	0		TW	NT	
23.04.2009	Review draft report		1			NT

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for our Client's particular requirements which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Renzo Tonin & Associates. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

The information contained herein is for the purpose of acoustics only. No claims are made and no liability is accepted in respect of design and construction issues falling outside of the specialist field of acoustics engineering including and not limited to structural integrity, fire rating, architectural buildability and fit-for-purpose, waterproofing and the like. Supplementary professional advice should be sought in respect of these issues.

EXECUTIVE SUMMARY

Renzo Tonin & Associates were engaged to assess noise and vibration impacts onto and from the proposed City One commercial and retail development at 301 George Street, Sydney to accompany an application for a Part 3A Concept Plan approval.

As a result of our assessment of the proposed development, the following potential acoustic issues were identified;

- General traffic noise from surrounding roads predominately George Street, Carrington Street, York Street and Margaret Street intruding into the proposed development
- Ground-borne rail noise and vibration intruding from train pass-bys in the underground City Circle railway line located approximately 80m to the west of the development into noise-sensitive areas of the proposed development
- Noise emission from the operation of the proposed development including mechanical plantrooms on various floor levels of the building, and the general activities associated with retail shops onto areas of the proposed development and existing adjacent buildings, and
- Noise and vibration generated from construction activities and equipment impacting upon existing premises.

This report presents an assessment of the above acoustic components in terms of current Australian Standards, Railcorp Interim Guidelines, NSW Department of Environment and Climate Change (DECC) Policy and requirements of Sydney City Council.

External Noise Intrusion into the Development

External noise intrusions into the development have been assessed in accordance with relevant Australian Standards, Railcorp and DECC Policy documents. The major noise intrusion sources were identified as road traffic noise. Regenerated noise and vibration from the underground railway lines was also investigated but found not to be an impact upon the proposed site.

On the basis of the external noise impacting upon the development site, appropriate design of the building envelope is required to achieve a suitable indoor amenity for occupants. Our assessment has established laminated glass or double glazing will be required on external building facades.

Noise Emission Generated by the Development

Noise from mechanical plant such as exhaust systems, air-conditioning, mechanical ventilation and refrigeration associated with the development has the potential to impact on nearby commercial properties. As details of mechanical plant are not available at this stage of the development in-principle noise control advice are present in this report.

Construction Noise

The major construction activities proposed on this site are excavation works, concrete pours and general building works. Construction and building work will be adequately managed so as to minimise disruption to the local community and the environment. As details of construction equipment and operating time are not available at this stage of the project, in-principle noise and vibration measures are provided in this report.

CONTENTS

List of Tables

1 INTRODUCTION

Renzo Tonin & Associates was engaged to conduct an environmental noise assessment of the proposed office and retail development, namely City One Wynyard, at the 301 George Street, Sydney in support of the Concept Application submission. This report presents a preliminary assessment of noise intrusion into and operational noise emission from the development in terms of current Australian Standards, NSW Department of Environment and Climate Change, Railcorp Interim Guideline and requirements of Sydney City Council.

The following is a list of potential acoustic issues relating to the above mentioned development:

- Airborne noise from rail pass-bys impacting the facade of buildings associated with the development as well as internal spaces.
- Ground-borne vibration from rail pass-bys impacting the occupants of the buildings associated with the development and as a result ground-borne noise being generated and impacting internal spaces.
- Nearby receivers could be impacted by:
    - noise and vibration during the construction phase
    - noise from mechanical plant during the operation of the development
    - noise from vehicle movements generated by the development

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001.

2 TRAFFIC AND RAIL NOISE

2.1 Road Traffic Noise

The proposed development is potentially effected by road traffic noise from George Street on the eastern boundary, Carrington Street on the western boundary, Margaret Street to the north and York Street across Wynyard Park from the development.

The applicable guideline for assessment of external traffic noise at building facades is NSW DECC's 'Environmental Criteria for Road Traffic Noise' and traffic noise levels inside commercial/retail building interiors is Australian Standard AS2107.

Renzo Tonin & Associates have previously conducted long-term traffic noise surveys on various parts of George Street in the Sydney City CBD and short-term noise measurements of buses travelling along York and George Street. Based on results of these projects, it has been observed that traffic noise levels on George Street is typically in order of 70 to 75dB(A) during peak hour and the maximum noise level from bus departing and stopping at stops on York and George Street ranged from 80 to 90dB(A). Typical building façade treatment to achieve compliance with internal noise levels recommended in the Australian Standard AS2107 is by the utilising laminated glass or double-glazed windows.

2.2 Rail Noise and Vibration

The proposed development is potentially effected by the underground rail network particularly train pass-bys on the City Circle line located approximately 80m east of the subject development.

There are no applicable Australian Standards or guidelines for the assessment of airborne and regenerated rail noise impacting upon commercial occupancies such as offices. In previous projects, Renzo Tonin & Associates have established appropriate rail noise and vibration criteria for commercial and retail development adjacent to railway corridor based on documents prepared by State Authority & Rail Infrastructure Corporation, Australian Standard AS2107, Department of Environment and Climate Change and the British Standard BS6472.

From our experience on similar projects with railway tunnels located at distance greater than 60m from noise/vibration sensitive buildings, the impact ground-borne noise and vibration upon occupants is insignificant and requirement for specific building mitigation is highly unlikely. Further to this, the noise-sensitive floors in this development is separated from the ground by two levels basement carpark providing an additional "buffer zone" to the transmission of vibration for the railway line.

3 MECHANICAL PLANT

Mechanical plant such as rooftop exhausts, air-conditioning and refrigeration associated with the development has the potential to impact on nearby residential and commercial properties. Although at this stage details of mechanical plant have not been finalised, the following in-principal advice are provided.

- Acoustic assessment of mechanical services equipment will need to be undertaken during the detail design phase of the development to ensure that they shall not either singularly or in total emit noise levels which exceed the noise limits in DECC's Industrial Noise Policy and/or City of Sydney Development Control Plans;

- As noise control treatment can affect the performance of the mechanical services system, it is recommend that consultation with an acoustic consultant be made during the initial phase of mechanical services system design in order to reduce the need for revision of mechanical plant and noise control treatment;

    - procurement of 'quiet' plant,
    - strategic positioning of plant away from sensitive neighbouring premises, maximising the intervening shielding between the plant and sensitive neighbouring premises,
    - commercially available silencers or acoustic attenuators for air discharge and air intakes of plant;
    - acoustically lined and lagged ductwork;
    - acoustic screens and barriers between plant and sensitive neighbouring premises; and/or
    - partially-enclosed or fully-enclosed acoustic enclosures over plant.

- Mechanical plant noise emission can be controllable by appropriate mechanical system design and implementation of common engineering methods that may include any of the following:

- Mechanical plant shall have their noise specifications and their proposed locations checked prior to their installation on site; and

- Fans shall be mounted on vibration isolators and balanced in accordance with Australian Standard 2625 "Rotating and Reciprocating Machinery – Mechanical Vibration".

4 CONSTRUCTION NOISE

The nature of the construction processes proposed for the development does not present difficulties in ensuring that the associated noise limits at surrounding properties are achieved. The major construction activities proposed on this site are excavation works, concrete pours and general building works.

Construction and building work will be adequately managed so as to minimise disruption to the local community and the environment.

Sydney City Council "Code of Practice – Construction Hours/Noise 1992" stipulated noise levels and time restriction construction activities. The aims of the code are to control and regulate noise and noise at unreasonable hours on all building sites within the local area.

All demolition and construction work conducted on the site shall comply with the noise level and operating time scheduled in Sydney City Council Code of Practice. Since detail of the construction equipment such as exact type, size, number and operating time are not know at this stage, in-principle noise control measures are provided in Section 4.1 which may be implemented to minimise any noise exceedances to the noise sensitive receptors where that may occur.

4.1 General Engineering Noise Control

Implementation of noise control measures, such as those suggested in Australian Standard 2436-1981 "Guide to Noise Control on Construction, Maintenance and Demolition Sites", are expected to reduce predicted construction noise levels. Reference to Australian Standard 2436-1981, Appendix E, Table E1 suggests possible remedies and alternatives to reduce noise emission levels from typical construction equipment. Table E2 in Appendix E presents typical examples of noise reductions achievable after treatment of various noise sources. Table E3 in Appendix E presents the relative effectiveness of various forms of noise control treatment.

Table 1 below presents noise control methods, practical examples and expected noise reductions according to AS2436 and according to Renzo Tonin & Associates' opinion based on experience with past projects.

Table 1 – RELATIVE EFFECTIVENESS OF VARIOUS FORMS OF NOISE CONTROL, dB(A)

Noise Control Method	Practical Examples	Typical noise reduction possible in practice		Maximum noise reduction possible in practice	
		AS 2436	Renzo Tonin & Assoc.	AS 2436	Renzo Tonin & Assoc.
Screening	Acoustic barriers such as earth mounds, temporary or permanent noise barriers	7 to 10	5 to 10	15	15
Acoustic Enclosures	Engine casing lagged with acoustic insulation and plywood	15 to 30	10 to 20	50	30
Engine Silencing	Residential class mufflers	5 to 10	5 to 10	20	20
Substitution by alternative process	Use electric motors in preference to diesel or petrol	15 to 25	15 to 25	60	40

The Renzo Tonin & Associates' listed noise reductions are conservatively low and should be referred to in preference to those of AS2436, for this assessment.

Table 2 below identifies possible noise control measures which are applicable on the construction plant likely to be used on site.

Table 2 – NOISE CONTROL MEASURES FOR LIKELY CONSTRUCTION PLANT

Plant Description	Screening	Acoustic Enclosures	Silencing	Alternative Process
Concrete Saw	✔	✔	x	x
Jack hammers	✔	x	✔	x
Mobile Crane	✔	✔	✔	x
Front End Loader	✔	x	✔	x
Pneumatic Hand Tools (general)	✔	✔	✔	✔
Bulldozer	✔	x	✔	x
Tracked Excavator	✔	x	✔	x
Concrete Trucks	✔	x	✔	x
Delivery Trucks	✔	x	✔	x
Dump Trucks	✔	x	✔	x
Truck (> 20 tonne)	✔	x	✔	x
Welders	✔	✔	x	x
Cherry Picker	✔	x	✔	x
Concrete Pump	✔	✔	✔	✔
Power Generator	✔	✔	✔	x
Light commercial vehicles	✔	x	✔	x
Silenced Air Compressor	✔	✔	✔	✔

To ensure efficient noise attenuation performance is achieved using any of the methods listed above, it is recommended acoustic engineers work closely with the construction contractors and carry out preliminary testing prior to commencement of works.

In addition to physical noise controls, the following general noise management measures should be followed:

- Plant and equipment should be properly maintained
- Provide special attention to the use and maintenance of 'noise control' or 'silencing' kits fitted to machines to ensure they perform as intended
- Strategically position plant on site to reduce the emission of noise to the surrounding neighbourhood and to site personnel
- Avoid any unnecessary noise when carrying out manual operations and when operating plant
- Any equipment not in use for extended periods during construction work should be switched off
- Noise compliance monitoring for all major equipment and activities on site should be undertaken prior to their commencement of work on site.
- In addition to the noise mitigation measures outlined above, a management procedure would need to be put in place to deal with noise complaints that may arise from construction activities. Each complaint would need to be investigated and appropriate noise amelioration measures put in place to mitigate future occurrences, where the noise in question is in excess of allowable limits.
- Good relations with people living and working in the vicinity of a construction site should be established at the beginning of a project and be maintained throughout the project, as this is of paramount importance. Keeping people informed of progress and taking complaints seriously and dealing with them expeditiously is critical. The person selected to liaise with the community should be adequately trained and experienced in such matters.

Where noise level exceedances cannot be avoided, then consideration should be given to implementing time restrictions and/or providing periods of repose for neighbouring receptors.

5 CONCLUSION

Renzo Tonin & Associates have completed an acoustic assessment of road traffic noise, ground-borne rail noise and vibration impacts onto the proposed retail and commercial development.

The study of external noise and vibration intrusion into the subject development has found that appropriate controls can be incorporated into the building design to achieve a satisfactory accommodation environment consistent with the intended quality of the building and relevant standards.

In principle acoustic advice and noise management measures have been provided to appropriately address potential impact from construction equipment and roof level mechanical plant rooms.

APPENDIX A - GLOSSARY OF ACOUSTIC TERMS

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

Adverse Weather — Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).

Ambient Noise — The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.

Assessment Period — The period in a day over which assessments are made.

Assessment Point — A point at which noise measurements are taken or estimated. A point at which noise measurements are taken or estimated.

Background Noise — Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the $\mathbf{L_{90}}$ noise level (see below).

Decibel [dB] — The units that sound is measured in. The following are examples of the decibel readings of every day sounds:

0dB The faintest sound we can hear

30dB A quiet library or in a quiet location in the country

45dB Typical office space. Ambience in the city at night

60dB Martin Place at lunch time

70dB The sound of a car passing on the street

80dB Loud music played at home

90dB The sound of a truck passing on the street

	100dB The sound of a rock band
	115dB Limit of sound permitted in industry
	120dB Deafening
dB(A):	A-weighted decibels The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter.
Frequency	Frequency is synonymous to pitch. Sounds have a pitch which is peculiar to the nature of the sound generator. For example, the sound of a tiny bell has a high pitch and the sound of a bass drum has a low pitch. Frequency or pitch can be measured on a scale in units of Hertz or Hz.
Impulsive noise	Having a high peak of short duration or a sequence of such peaks. A sequence of impulses in rapid succession is termed repetitive impulsive noise.
Intermittent noise	The level suddenly drops to that of the background noise several times during the period of observation. The time during which the noise remains at levels different from that of the ambient is one second or more.
L_{max}	The maximum sound pressure level measured over a given period.
L_{min}	The minimum sound pressure level measured over a given period.
L_1	The sound pressure level that is exceeded for 1% of the time for which the given sound is measured.
L_{10}	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L_{90}	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L_{90} noise level expressed in units of dB(A).
L_{eq}	The "equivalent noise level" is the summation of noise events and

	integrated over a selected period of time.
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
SEL	Sound Exposure Level (SEL) is the constant sound level which, if maintained for a period of 1 second would have the same acoustic energy as the measured noise event. SEL noise measurements are useful as they can be converted to obtain Leq sound levels over any period of time and can be used for predicting noise at various locations.
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Absorption	The ability of a material to absorb sound energy through its conversion into thermal energy.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Pressure Level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound Power Level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Tonal noise	Containing a prominent frequency and characterised by a definite pitch.